

Chapter 4: Hypernotes

WWW 4:1

The story is told by Fritsch (1968), who attributes it to the German psychologist Kurt Elze, who in 1924 invented the term ‘right-left-blindness’ (Elze, 1924; Elze, 1926).

In *Paradise Lost*, IV: 785, Milton describes the army of Cherubim, “Half wheeling to the shield, half to the spear” (Fowler, 1971).

WWW 4:2

Care has however to be taken when people are declared to have right-left confusion. For instance, Fritsch (1968 p.54) mentions that the physicist Helmholtz was described as being “‘right-left blind’ to a very high degree”, whereas Benton (1959 p.58) is sceptical, emphasising only that Helmholtz described himself as having difficulty discriminating right and left when a child.

Freud described his difficulty in a letter to Wilhelm Fliess, Jan 4th, 1898 (Freud, 1985). Although 'right' and 'write' sound the same in English, the trick does not work quite as well in German, where *rechts* (right) and *schreiben* (to write) aren't pronounced in the same way; nevertheless, as Freud found, the method solved his problem.

WWW 4:3

Even navigation in cities is not easy. As an eighteen-year old taking my driving test, the examiner told me to turn left at the next junction. I immediately moved into the middle of the road and turned right; this being England, he smiled and said he'd thought he would start with something easy, but I'd now shown him I could do one of the more complicated manoeuvres.

WWW 4:5

The best simple introduction to Proto-Indo-European is Crystal (1987a). For a more detailed and technical but highly accessible description of the details of how it is reconstructed, as well as examples of many of the wide range of scripts and languages, see Beekes (1995). My own introduction, many years ago, to proto-Indo-European was through Anthony Burgess's elegant little book called *Language made plain* (1964).

WWW 4:6

As an example of another law, Brugmann's Law says that a long *a* in Sanskrit will become an *o* in Greek. There were exceptions, of course, but these also were rule-bound. August Leskien, a scholar of the Slavic languages, emphasised the 'regularity of the sound laws', whereby sounds in one language are modified in a regular systematic fashion to become different sounds in other languages. Collinge (1985) has an account of all the various sound laws in Indo-European languages.

The concept of systematic change in languages is in some ways very similar to that of change in genetics by mutation and selection. New words appear quite spontaneously, and of the existing words, some are more successful and are used more often, so survive better. Speciation also occurs simply by geographical separation, just as sub-species and then species of animals and plants occur by physical separation coupled with genetic drift and selection for a slightly different ecological niche. The important difference between genes and language is that genes only spread *vertically* (i.e. from parent to child) whereas linguistic components can spread *horizontally* (just as viruses spread horizontally – I can 'infect' you with a cold or a new word which you then spread further yourself). Ultimately words and other parts of language are ideas, and in some sense the concept of a 'meme' fits well with them (see Blackmore 1999).

WWW 4:7

Germanic and East Germanic, like Proto-Indo-European, are themselves languages without any written records, and therefore they have been reconstructed from their descendants.

Renfrew (1987b) has a good account of the romantic stories of Hittite and Tocharian. Examples of the scripts can be found in Beekes (1995).

One of the great successes of the reconstruction of Proto-Indo-European was the hypothesis put forward by the great Swiss linguist, Ferdinand de Saussure (1857-1913) that some of the anomalies of reconstruction could be got round if one suggested the existence of extra consonants which are not present in present-day Indo-European languages. It was a brave claim indeed, and Saussure referred to these additional consonants as 'laryngeals', by analogy with similar sounds in modern Semitic languages which are produced at the very back of the throat. The theory was dramatically vindicated when in 1927 it was shown that Hittite indeed had sounds in precisely the right form. The laryngeals are indicated by the symbol **H** in the reconstructions below.

As well as nouns describing the objects and ideas of the proto-Indo-European world, verbs describing the things that they did, numbers for counting, pronouns for referring to each other, and so on, the proto-Indo-European vocabulary also contained adjectives, very many of which are paired. As examples we have:

good	*wesu-/*su-	*t'us-	bad
high, top	*b ^h erǵ ^h -	*nī-	low, bottom
wide, flat	*p ^h (e)l-H-/-t ^h	*Hanǵ ^h -u-	narrow
full	*p ^h lH-(no-)	*wāst ^h o-	empty, devastated
large	*mek ^h H-	*d ^h eb ^h -	small
thick, solid	*b ^h enǵ ^h -	*t ^h en-	thin
long	*t'elH(n)g ^h o-	*mreǵ ^h u-	short
heavy	*k'o(e)r-u	*leg ^h o-	light
new	*newo-	*wet ^h o-	old
white, light-coloured	*alb ^h o-	*mel-	black, dark

Even a brief glance at these words suggests things with which we are very familiar (even if as Esperanto sometimes seems, it is familiar but incomprehensible). Some words look extremely close to English itself (***newo-** for **new**, or ***t^hen-** for **thin**), and others have resonances in English because we have words that are related to them (***alb^ho-** and **albinism**, ***mel-** with **melanin**, ***mek^hH-** with the prefix **macro**, and ***b^herǵ^h-** with the German **berg** for a mountain).

It is almost tempting at this point to wonder whether one could understand proto-Indo-European if it were spoken. The answer on theoretical grounds is almost certainly no, since we know that modern English speakers have difficulty in making sense even of the Middle English in which Chaucer wrote *The Canterbury Tales*, and that the Old English in which *Beowulf* was written is almost incomprehensible to the modern ear. For those though who would like to find out for themselves, they should watch out for a film released in 1981 called *Quest for Fire*. Films about pre-historic times are not normally renowned for their attention to scientific detail (one thinks of *One million years BC* in which Raquel Welch wears a fur bikini and is chased by a dinosaur, despite dinosaurs having been extinct for 64 million years). *Quest for Fire* though is different in one interesting respect. The script was written by the novelist Anthony Burgess, who, as well as writing books such as *A clockwork orange*, was also a gifted amateur linguist¹. He therefore wrote the script entirely in proto-Indo-European². I once saw the film in Heidelberg on the grounds that I wouldn't have been able to understand the dialogue in any of the other films being shown in the cinema, but with *Quest for Fire* I knew I would be as baffled as everyone else in the cinema.

¹ His most ambitious achievement was the seemingly impossible task of translating James Joyce's *Finnegans Wake* into Italian.

² It must be said, from memory, that there were other aspects of the film which did not show the same attention to verisimilitude. Fire had probably been discovered long before proto-Indo-European had been spoken, and there was little indication of the village, agriculturalist life around which the vocabulary of proto-Indo-European seems to centre. And it seems unlikely that sex from the front rather than the rear was discovered so late in human evolution, although it made good cinema. According to *Halliwell's Film Guide*, *Quest for Fire* is set eighty thousand years ago. That is long before Proto-Indo-European would have been in use, and even sixty thousand years or more before Nostratic. It is however probably within the range during which modern humans were probably using a sophisticated language equivalent to that in use today.

☞ WWW ☜ 4:9

These are the reconstructions of, respectively, Buck, p.865 (Buck, 1949), Gamkrelidze and Ivanov, p.686 (Gamkrelidze & Ivanov, 1995), and Delamarre (1984) (Delamarre, 1984). Delamarre (1984) does reconstruct *laiwos / *sewyos / *skaiwos, but he is an exception.

☞ WWW ☜ 4:10

With characteristic honesty, Hertz acknowledges in a footnote that the idea had already been suggested in 1906 by Meillet. Gamkrelidze and Ivanov, who do not cite Hertz, also seem unaware of Hertz's other major theoretical point, that physiology can do nothing to explain the symbolic pre-eminence of the right hand, suggesting, "This association of right with the favourable, good and positive, and left with the unfavorable, bad, and negative, can be regarded as a semantic universal of language. It is of course based on the typical differential physiological capacity of the human right and left hands."

☞ WWW ☜ 4:11

See Hamilton & Deese, 1971. Clark (1973) points out that in the pairs *long-short*, *far-near*, *tall-short*, *high-low*, *deep-shallow*, *wide-narrow*, *broad-narrow*, *thick-thin*, the first member (in italics) is unmarked, and the second (in bold), is marked.

The marking often involves *-w^e/o- in the Germanic languages, in pairs such as 'west' and 'east', or 'winter' as opposed to 'summer' (Mallory & Adams, 1997 p.349; Markey, 1982 p.189).

☞ WWW ☜ 4:13

The word Nostratic comes from the Latin *nostratis*, meaning "our countryman", a rather ethnocentric term which has since been criticised. For an introduction to Nostratic see Ross (1991), for a critical review of the concept see Salmons and Joseph (1998a), and for a dictionary of Nostratic see Dolgopolsky (1998b). It is unlikely that Nostratic will have a reconstructable word for left, since none exists in Proto-Indo-European, but it is possible one will exist for right.

☞ WWW ☜ 4:14

The originals of the postage stamp and the dollar bill look like this:



The photograph of Hale-Bopp was taken by Howard Taylor, at Chandler's Ford in Hampshire, UK, and was downloaded from the InterNet (<http://www.jpl.nasa.gov/comet/taylor1.html>), where many other images of the comet can also be found. The comet actually looked like this:



WWW 4:15

The study of Hale-Bopp also found a small difference between right and left handers, 57% of 189 left-handers getting the right-left orientation correct compared with 65% of 190 right-handers (Martin & Jones, 1999).

WWW 4:16

Novelists are not always exact about the precise timing of their observations. In Italo Calvino's *Il visconte dimezzato* (*The cloven viscount*), the nurse says, "Can't you tell left from right any more? And yet you learnt when you were five...".

Winnie-the-Pooh has been used extensively as the theme for the elegant book on symmetry by Rosen (1975).

WWW 4:17

The ages quoted are based on the study of Elkind (1961). It is conventional to quote the age at which a task can be completed as that at which 75% of children do it correctly. Similar results are found in the study of Dellatolas *et al* (1998c).

WWW 4:18

Piaget (1928 pp.202-3) comments that, "One of the most striking things one finds about the child under 7-8, is his extreme assurance on all subjects. ... 'I know!' – such is the only proof that is used for a long time in childish logic. True, the child is always asking questions, but up to the age of 7-8 a large number of the questions are rhetorical: the child knows his own answer..."

WWW 4:20

Perhaps the most extreme case of left-right confusion is described in the book of *Jonah* (4:11), where we are told about "Nineveh, that great city, wherein are more than six score thousand persons [120,000] that cannot discern between their right hand and their left hand".

Biblical scholars (Sasson, 1990; Wade, 1925) seem to regard it as having a metaphorical rather than literal meaning. One possibility is that it refers to young children, who are incapable of distinguishing their right and left hands, and that would be compatible with the population of 120,000, since the total population of Nineveh at its peak has been estimated at 300,000 (Sasson, 1990 p.311). An alternative explanation is that it refers to some form of mental or, more likely, moral handicap, but that does not seem compatible with the overall context. Perhaps the best explanation is that of Sasson who suggests it is a description of the sheer size of Nineveh, vast by Biblical standards, and, "so teeming with life that Ninevites do not know who their neighbours are" (Sasson, 1990 p.315), not knowing who lives to their right or left sides.

Although there have been concerns that women may merely *report* more often that they have problems with left and right (Williams, Standen, & Ricciardelli, 1993), there is experimental evidence that women actually do carry out left-right discrimination tasks less quickly than men (although not less accurately) (Snyder, 1991). Interestingly it does however seem that in children, girls and boys do not show any difference in distinguishing right and left (Benton, 1959 p.34), and it is not clear at what age the difference emerges.

WWW 4:21

In the experiment proper, subjects were presented with four sets like that shown in the figure, containing a total of 80 hands. Control subjects who reported no problems at all with distinguishing right and left in everyday life took 38 seconds to say whether the hands pointed up or down, 61 seconds to say whether they pointed to right or left, and 142 seconds to say whether they were right or left hands. Subjects reporting right-left confusion took 43, 70 and 178 seconds for the same tasks (Brandt & Mackavey, 1981)

WWW 4:22

The account is describing experiments 4 and 6 of Sholl and Egeth (1981). Essentially similar results have been found by Maki (1979a). The question has been controversial with the study of Farrell (1979b) finding a suggestion of perceptual differences between right and left, although the results do not seem to replicate.

WWW 4:24

Mach (1838-1916), who said, "the distinction between right and left depends upon an asymmetry", was both a Professor of Physics at the University of Prague and a Professor of Philosophy at the University of Vienna. He is probably best known now for his work on the shock waves travelling ahead of fast moving objects, and the measurement now known as the Mach number, of the ratio of the velocity to the speed of sound. He was also a successful populariser of science whose *Popular Scientific Lectures* (Mach, 1910) are still an interesting and entertaining read. His introduction to the *Lectures* sets the task well for the modern populariser: "[The author] must select ... easy subjects, and restrict themselves to the exposition of the simplest and the most essential points. Nevertheless, by an appropriate choice of the matter, the *charm* and the *poetry* of research can be conveyed by them. ... such lectures can exercise a favorable influence by showing the substantial sameness of scientific and everyday thought. The public, in this way, loses its shyness towards scientific questions...".

☞ WWW ☞ 4:27

Gerstmann published his first case report in 1924, and described two more cases in 1927, but it was only when he published further cases in 1930 that right-left disorientation was included as a key part of the syndrome.

Although Gerstmann was the first to describe the association of his tetrad of symptoms, the first description of neurological patients with confusion of right and left was made four decades earlier by Obersteiner (1882) who described “a peculiar sensory disorder”, which he called *allochiria*. Many papers were published on the symptom over the next quarter of a century, often only confusing the situation. Much clarification came with the work of Ernest Jones, the future biographer of Freud, who emphasised that many cases were hysterical in origin, and that, in a very modern phrase, the condition “is primarily a disturbance of the sense of right- or left-handedness”, “a mental defect of the specific feeling of ‘sidedness’ ” (Jones, 1907).

Occasional cases do occur in the right hemisphere, in at least one case of which the patient was left handed (Moore et al., 1991). The precise location of the lesion in Gerstmann’s syndrome is still not exactly clear; Dehaene *et al* (1998d) have placed it “in the vicinity of the intra-parietal sulcus”, deep in the parietal lobe.

Finger agnosia is an extremely difficult symptom for which to gain any sense of empathy. Kinsbourne and Warrington (1962) suggested that, “The fingers were treated by the patients, in some respects, as if they were an undifferentiated mass”. Imagine perhaps that they have been permanently stuck together with superglue or sticking plaster, or, in contrast, imagine trying to have a properly *separate* feeling for each of the bones in your wrist or the body of your foot.

The Oscar Wilde quote comes from Critchley (1966 p.184). I have not been able to find the original source.

☞ WWW ☞ 4:29

Galton said that “The pattern or ‘form’ in which the numerals are seen is by no means the same in different persons, but assumes the most grotesque variety of shapes, which run in all sorts of angles, bends, curves and zigzags...”

The number form is taken from Spalding and Zangwill (1959). The patient was a 24 year-old soldier, wounded in October 1944, with a problem of calculation and damage to the angular gyrus on the left side. He attributed his mathematical problems to the loss of his number form which had occurred as a result of the shrapnel wound.

The numbering of the fingers does differ in different countries, and I am using English nomenclature which does not count the thumb, so that the first finger is the index finger, the third the ring finger and the fourth the little finger or pinkie.

The relationship between numbers and left and right is shown in a fascinatingly elegant experiment by Dehaene. In his experiment subjects looked at a number flashed on a screen and had to say whether it was odd or even by pressing with their left hand if it was even, and with their right hand if it was odd. The unexpected result was that for small numbers, people were faster with their left hand, whereas for bigger numbers they were faster with their right hand. The implication of what has been called SNARC ('spatial-numerical association of response codes') is that for most people numbers are indeed laid out mentally from left to right³. The neat twist on this experiment is that it was also carried out with a group of Iranian students, who had been taught to read and write from right to left. The pattern of results was similar except that they were faster with the *right* hand for the smaller numbers and the *left* hand for the larger numbers⁴. It seems that the way we organise numbers from left to right inside our heads is in part related to whether we write from left to right or vice-versa (Butterworth, 1999).

WWW 4:30

An influential theory of vision distinguishes between two separate streams in the brain, a ventral stream "coding for perception", which ends in the infero-temporal cortex and is concerned with form perception, and a dorsal stream "coding for action", which ends in the posterior parietal cortex and is mainly concerned with action (Milner & Goodale, 1995). It would seem that action needs to know about the right and left of objects, whereas form can to a large extent ignore it. That is supported by the almost paradoxical result that monkeys with damage to the infero-temporal cortex are relatively *better* than control monkeys at distinguishing mirror-images (Gaffan, Harrison, & Gaffan, 1986; Milner & Goodale, 1995 p.152). JBA, a patient who also had bilateral parietal lesions, could only distinguish an object from its mirror image if she *couldn't* name the object (Warrington & Davidoff, 2000) RJ's lesion is parietal and might therefore be expected to impair his awareness of right and left but leave perception of objects intact.

WWW 4:31

Wood Jones, 1941; Wood Jones, 1949. Wood Jones' classic textbook on the hand, one of the few medical textbooks from the 1940s still on the open shelf in my medical school library, was written during the first World War, "in the intervals of military service and air raids", and the second edition during the second World War, "during the intervals between routine duties and air-raid signals". Wartime probably provides all the experience a hand surgeon could ever require.

Right-handed neutrinos were mentioned by Quinn and Witherell (1998e); the correction was published on p.6 of the January 1999 issue. In an article published in 1958 Abdus Salam,

³ Dehaene, S., Bossini, S. & Giraux, P. *Journal of Experimental Psychology: General* 122: 371-96, 1993 Dehaene, Bossini, & Giraux, 1993. A similar effect was *not* found for letters of the alphabet.

⁴ There is a potential confusion here to do with what in the West are called 'arabic numerals', i.e. 1,2,3,etc.. Numbers in the Arabic language are written in what is known as the 'east Arabic' system, with ١٢٣٤٥٦٧٨٩ representing respectively the digits one through nine. However, although Arabic in general is written from right to left, the place system of the numbers is written, as in Western scripts, from left to right. As a result, ١٢٣ represents the number one hundred and twenty three (123) and not three hundred and twenty one (321).

who was one of the first theoreticians to understand the neutrino, had written, “right-polarized neutrinos exist but left polarized neutrinos do not”, which seems also to be an error (Salam, 1958 p.103). It must be said though that although Salam was one of the first to realise that neutrinos explained the failure of conservation of parity, the equations themselves could not say whether neutrinos were right or left handed, that being a matter to be resolved by experiment (Fraser, 2000 pp.132-135).

Dr Tom Schneider, of the Laboratory of Computational and Experimental Biology at the National Cancer Institute in Maryland, has his left-handed DNA site at www.lecb.ncifcrf.gov/~toms/LeftHanded.DNA.html. The site repays a visit, being beautifully illustrated with lots of hyperlinks. Particularly interesting are the journals and companies which refuse to allow their errors to be reproduced. For those who would like an up-to-date example then the back cover of the issue of *Science* for 25th Jan 2002 shows a nice example of left-handed DNA.

Although most DNA has what is called a B structure, DNA can spontaneously form a true left-handed spiral known as Z-DNA (Wang et al., 1979). Recently it has been discovered that there are enzymes that bind to Z-DNA specifically meaning it must have a role, albeit one that is not understood, in normal cell metabolism (Schwartz et al., 1999).

An intriguing historical example where commercial examples do not seem to have cared about right and left is the one discussed by Stephen Jay Gould in his essay “Left snails and right minds (1997 pp.202-217). He had noticed that in an early book on conchology, by Nehemiah Grew in 1681, the dextral snails were all illustrated back to front (as also was the unusual inverted, sinistral, snail, which was shown the ordinary way round). At first Gould like many of us assumed it was incompetence or carelessness, but then he found a series of other examples from this time period which were also illustrated in the same way. He wonders whether it might be a convention (just as astronomers usually print their pictures upside down, because that is the way they look through their telescopes), but then comes down on a psychological theory: “the conceptual world of pre-eighteenth-century zoology must have accorded little importance to the orientation of a shell”. An alternative is that engravers found it difficult to reverse images and the default was to allow *all* of them to be reversed unless there were strong reasons why it mattered which way round they were (as with lettering). And since most organisms are symmetric anyway, it would be impossible in general to tell.

Time is no guarantee that such left-right errors will be picked up. The 1997 re-issue of Watson's *The Double Helix*, was published by Weidenfeld and Nicolson, and it was reprinted in paperback in 1999 by Penguin Books, and although the cover shows a different picture of DNA it is also back to front. Perhaps at this point I should also say that since Weidenfeld and Nicolson are also publishing this book I will be extremely careful in doing my checking. Nevertheless I will be amazed if some chirality gremlin doesn't creep into the works.

The error in *Nature* occurred in the caption of an illustration on p.737, 15th June 2000. See Porter (2000), who also points out plenty of left-handed DNA being illustrated in other articles on functional genomics in the same issue. Likewise *Scientific American* managed to illustrate an article celebrating the sequencing of the human genome managed with several examples of left-handed DNA. I have stopped counting the number of advertisers or popular newspapers that show left-handed DNA. It is more interesting though when one finds the

error in substantive scientific articles in substantive scientific journals, and, almost as this book goes to press I notice yet another in *Nature* (Downward, 2001 figure 1).

After all this discussion about how confusing right and left can be, you might ask how I, a psychologist, cope with it. Needless to say I am no better than anyone else. Like Freud I use various motor mnemonics to remember which side is which. Certainly I seem incapable of knowing which is a right hand spiral without making tiny screwdriver-like movements with my right hand. When all else fails, though, I have an infallible method. They were bought for me by Barbara Bulman-Fleming, a dear friend who is also a laterality researcher – a pair of socks, one of which has the word ‘right’ in a dozen or more languages and the other has the word ‘left’ in the same Babel. I sometimes wear them when giving popular lectures on handedness and lateralisation. The only problem, of course, is knowing which one goes on which foot....

Chapter 4 was originally meant to end with our translation of a charming poem by the Austrian poet, Ernst Jandl. However due to seemingly insuperable copyright problems, it was eventually omitted from the book. Here however is the poem, firstly in the original German (Jandl, 1997 p.74), and then in our translation⁵. There is also a published translation by Anselm Hollo (Jandl, 2000).

lichtung

manche meinen
lechts und rinks
kann man nicht
velwechsern.
werch ein illtum!

dilection

some think
reft and light
cannot be
at arr mislead.
they ale misred!

⁵ Translated (©) by Christine Pleines and Chris McManus.

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